# PART I. JAPAN TEAM : 9. China's Regional Industrial Disparity from the Viewpoint of Industrial Agglomeration

# 9

# China's Regional Industrial Disparity from the Viewpoint of Industrial Agglomeration

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## 1. INTRODUCTION

Industrial location is unevenly distributed in the People's Republic of China (PRC). Although China has obviously achieved historical growth as indicated by the annual average GDP growth rate from 1979 to 2001, 9.4%, it is mainly observed in the eastern area (the coastal area), not in the central and western area (the inland area). Therefore, the growth rate does not represent the whole of China's industry. This means that there is a spatial unevenness of economic activities. Although we need to investigate the relation between income and industrial disparity precisely, it is inferred from views of scissors-like difference in prices, income differential between agriculture and industry, and so on that industrialization raises income in the relative agricultural inland area.

To explain the industrial disparity, industrial agglomeration also has to be considered for investigating industrialization in China, like sources of economic growth such as capital accumulation, foreign direct investment, technology diffusion, etc.[1] Therefore, in this paper we will not attempt an investigation of economic growth in the whole of China, but rather will study the appearance of development and underdevelopment from the viewpoint of industrial agglomeration.

This work follows theoretical literature on recent geographical economics and positive literature on China's industries. The former include Krugman [1991], Fujita *et al.* [1999], Fujita and Hamaguchi [2001], Mori and Nishikimi [2002], and Fujita and Thisse [2002]. There is empirical literature, such as Kim [1995], Ellison and Glaeser [1997], Yue [2000], Hanson [2001], Sonobe and Otsuka [2002]. This spatial economics, a 'new economic geography,' is a method of analysis for spatial economic structure with monopolistic competition developed by Dixit and Stiglitz [1977], and transportation costs expressed as iceberg transport. The latter positive literature includes Onoe [1971], Kato [1997, 2000], Qiu [1999], Seki and Nishizawa [2000], Cai and Du [2000], Amiti and Wen [2001], Fujita and Hu [2001], Kuroda [2001], Marukawa [2001], Tuan and Ng [2001], Wei [2002], Jin and Zhu [2002], and Batisse [2002]. These studies mentioned cover not only spatial disparity and provincial differences, but also industrial agglomerations. Especially, it is considered that regional integration has the possibility to bring agglomerating through division of labor among regions, such as Kato [1997, 2000], and Xu [2002]. This work refers to Kato [2000] based on Krugman [1991]. He investigated domestic market integration and regional development through concentration of manufacturing in a few regions modeled by Krugman. However, the investigation put weight on inter-regional division of labor, not on industrial agglomeration directly.

The purpose of this paper is to examine the regional industrial disparity mentioned above from the viewpoint of industrial agglomeration. Industrial agglomeration is a phenomenon whereby a lot of firms belonging to the same and associated industry concentrate geographically, moreover they have dealings with each other.[2] This chapter attempts to explain Chinese agglomeration with data and personal interviews based on spatial economics. And, here, we will take up the macroeconomic situation between the eastern area and the rest of China mainly, rather than detailed investigations of local industries.[3]

Methodologies of this chapter are the following. Firstly, we will investigate such concentrations since the beginning of contemporary Chinese history from the viewpoint of industrial agglomeration. The originality is that some macro data and facts are utilized with a basic model of spatial economics to explain industrial agglomeration through linkages in China. In addition, we will investigate the western development in the context of inevitability of agglomeration in the eastern area as a policy implication for developing economies.

The conclusion of this chapter is that linkages to bring industrial agglomeration observed in the machinery industry mainly in the eastern area is one of the factors to explain China's regional industrial disparity. Therefore, a policy implication from the conclusion is that it is difficult to let the inland area develop under the core-periphery structure. But, it will be supposed that the inland development policy has to let characteristics in each inland area develop pillar industries as the government is practicing now.

The contribution of this paper is that some key parameters to explain agglomeration in Krugman [1991] are reconsidered clearly with some facts utilizing the theory. Therefore, this will be a clue for empirical study.

But, some issues to be solved also remained. Firstly, transportation cost which is one of the keys to decide whether to agglomerate or not is not dealt with here. Secondly, statistics of industrial value of each province have to be normalized by, for example, population and industrial structure. Thirdly, we have to analyze the situation empirically to consider it exactly, as mentioned above. Fourthly, the lower levels of administrative division, such as the city level or the county level, also should be analyzed definitely as studied by Onoe [1971], Qiu [1999], Seki and Nishizawa [2000], Kuroda [2001], and Marukawa [2001]. This is ignored as the result of the contribution mentioned above. Finally, other factors to explain agglomeration are also considered in addition to linkages examined here.

The rest of this paper is organized as follows. In section 2, we confirm the regional disparity with descriptive statistics, and a brief contemporary history. Section 3 considers the mechanism of industrial agglomeration. In section 4, as a policy implication, we examine the western development. Section 5 concludes with some remarks.

## 2. CHANGE OF REGIONAL INDUSTRIAL DISPARITY

### 2.1. Index of Regional Industrial Disparity

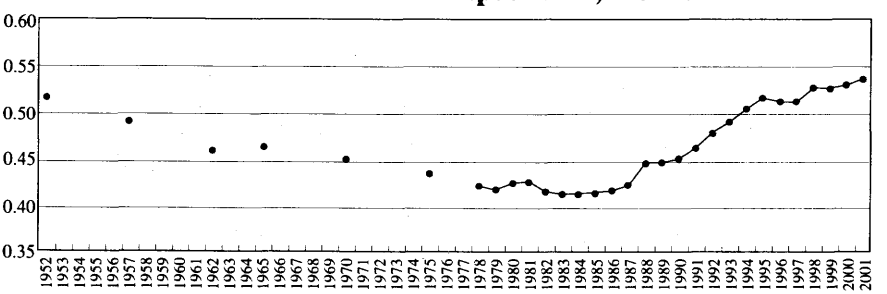
In this section, industrial disparity indices of the mining and manufacturing industries will be shown. The subject of administrative division is the first class, that is to say, provinces, municipalities, and autonomous regions.[4] There are 31 divisions at present.

To explain regional differentials, we apply Gini's coefficient as an index of industrial disparity, that is to say, measuring a concentrated (maldistributed) distribution of production value in the whole area. Although there are some indices to explain disparity, such as Gini's coefficient and Theil's

index, as we do not decompose reasons of inequality, Gini's coefficient will be utilized here. Certainly, the coefficient is for scaling income disparity, however, here we let a horizontal axis of Lorenz curve be an accumulated number of provinces and a vertical axis represent the accumulated gross industrial output value (hereafter, GIOV).[5] Therefore we call it the industrial disparity index hereafter. Since the concept of 'industry' in China is broader than general statistical classification, this GIOV is what is called the mining and manufacturing industries. If this industrial disparity index closes to one, it means that there is a big gap in production among provinces, and vice versa. Therefore, if every province has the same ratio of GIOV, namely perfect equality, for example, it is about 3.23% in the present case, the industrial disparity index is zero.

Figure 9.1 shows the changes in China's regional disparity.[6] We see from the figure that production disparity declined from the time of the nation's foundation to the latter half of 1980s, after that, the degree of disparity starts rising to the present time. This curve is related to given circumstances and policies. A brief history will be introduced here.[7]

**Figure 9.1: Industrial Disparity Index of Gross Industrial Output Value, 1952-2001**




Note 1: Before 1997, all industral enterprises. After 1998, all state-owned and non-state-owned industrial enterprises above designated size refer to all state-owned industrial enterprises plus the non-state-owned industrial enterprises with an annual sales income of over five million yuan.

2: The GIOVs are calculated at current prices. The Hebei's figure of state-owned and collective-owned enterprises before 1988 are calculated at constant prices, since 1989, they are culculated at current prices.

3: The figure for Guangdong in 1995 is selected the upper section in the statistics.

Source: The figures for 1957 to 1998 are from Department of Comprehensive Statistics of National Bureau of Statistics [1999]. *Comprehensive Statistical Data and Materials on 50 years of New China*, Beijing: China Statistical Press.

The figure for 1998 to 2001 are from National Bureau of Statistics of China, *China Statistical Yearbook*, various years.

## 2.2. Brief History

### *2.2.1. Initial Conditions during the Founding*

Modern China was founded under the leadership of the Chinese Communist Party in 1949. As the value of 1952, 0.5181, is an initial condition, it is the largest number except for the latter half of the 1990s. An unbalance of industrial locations is guessed from the figure. According to Kojima [1997], Chinese industry was in a severe situation. Half of the spinning industry, food industry, and general merchandises were in Shanghai, and the other half in Tianjin and Qingdao. Although most of the factories were removed by the USSR, some heavy industry constructed under Japanese occupation located in the northeastern area remained, such as the Anshan Iron and Steel (Group) Company.

### *2.2.2. First Dispersion before the Economic Reform*

The disparity index in this period was declining by about 0.1 point. Since China adopted a socialist market economy, the government invested in projects of industrialization giving them priority over heavy industries. In the first Five-Year Plan (hereafter, FYP) from 1953 to 1957, 117 projects of the 156 national priority projects aided by the USSR were located in the central and western areas to correct the gap of production. In addition, these projects were financed by taxes and the profits of state owned enterprises (hereafter, SOE).[8] These projects for industrialization and finance assistance were then reallocated to inland provinces.

In the mid-1950s, although there was a mood of detente, relations between China and the US were aggravated because of Korea and Taiwan. In addition, the criticism of Stalin by Nikita Khrushchev in February 1956 led to a Sino-Soviet controversy over revisionism. At last in 1960 the opposition between China and the USSR came to the surface. China had antagonized both the USSR and the US and this meant it was isolated from both camps, namely, China was isolated internationally. At this point China adapted a slogan for economic establishment named self-reliance. One of the characteristic terms at that time was the Construction of the Third Front.[9] This was, due to a strategy for national defense in the 1960s to 1970s, a rearrangement turning toward the inland area for the mining and manufacturing industries. According to Marukawa [1993], the 'Third Front' includes the whole or most of Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai,

and Ningxia, or the western parts of Shanxi, Henan, Hubei, and Hunan in addition to the above seven provinces.

### *2.2.3. Second Dispersion in the 1980s after the Economic Reform*

Although the Chinese economy was centralization before the economic reform, after 1978, local governments also had decision-making authority because of the decentralization of power and revision of the financial system. Therefore, these local governments intended to have profitable industries in each province. This regional protectionism led to a lordship economy that brought about overlapping investment in same industries in China. Therefore, as seen in Figure 9.1 in the 1980s, the dispersion had continued after the strategy of balanced industrial location.

### *2.2.4. Concentration in the 1990s*

Setting up special economic zones in the south coastal area and other development zones especially the coastal area after the end of the 1970s drove China's economic growth. And, it is likely that the economic reform for cities after 1984 had achieved results. The Southern Tour Lectures in the beginning of 1992 by Deng Xiaoping led to high growth especially in southern coastal cities after experiencing the aftereffects of the Tian'anmen Incident in 1989. After a reduction of disparity in the eastern area in the 1980s and a rise of total share in the eastern area as a whole, the industrial disparity index began to increase.

## 2.3. Movements of Production Bases

Related to the index and the history, the other Table and Figures are also presented here as explanations for movements of production bases. Table 9.1 has some results on centralization of production by year.

Columns from the second to sixth show that the higher-ranking five provinces have changed. Seeing only the coastal area except Liaoning, although the northeastern area had a high share at first, the southeastern area has increased its share after the mid-1980s. The Yangtze River Delta area has kept a high share as a whole area however Shanghai dropped in rank since the mid-1980s till the mid-1990s. Especially symbolic is that the rankings of Shanghai and Guangdong were reversed in 1989. The Pudong new district in Shanghai started to develop in 1990, on the other hand, much for-

eign direct investment had already gone to Guangdong. Jiangsu raised its ranking after the economic reform and ranked first from the latter half of the 1980s to the first half of the 1990s. Although we do not take up the capital classification here, it would be related with a lot of township and village enterprises. After the latter half of the 1990s, Zhejiang has been ranked in the above five provinces in production value. From this time, the existence of the Yangtze River Delta has been cleared. Shandong has had a high share constantly. The province has not only high GIOV but also high agricultural value. Its agricultural value accounts for about 10% and ranks first in China. Indeed, we can think of Shandong as an independent economic zone.

Next, we turn to the inland area including Liaoning. In the northeastern area, Liaoning and Heilongjiang are also ranked into the Table however Liaoning, a long-time table entrant, fell out in the beginning of the 1990s. In the northeastern area, Tianjin had been ranked three times before the economic reform. Similarly, Beijing had also been ranked till the first half of the 1980s. In the last half of the 1990s, Henan, Hebei, and Hubei belonging to the central area ranked in fifth. Certainly, provinces classified as the eastern area have high shares basically, however, those provinces near the coast or along the Yangtze River were also developed as industrial provinces. In the inland area, only Sichuan was in the fifth rank till the mid-1980s. We therefore know that the other provinces in the western area and whole provinces in the central area have low shares.

The seventh column of Table 9.1 shows the sum of shares of the above three provinces has changed. This change has almost the same shape of the industrial disparity index. First of all, even all-fifth provinces have shares of just around 5 to 7%. Eventually, all provinces except for above five provinces have low shares as mentioned in the above paragraph.

The eighth column of the Table 9.1 and Figure 9.2 show three-areas, the eastern, central, and western, shares of GIOV from 1952 to 2001.10 In the eastern area the percentage, 68.9% in 1952, decreased to 60.6% by 1986. In the central area the percentage, 23.9% in 1952, increased to 28.8% by 1986. In the western area the percentage, 7.2% in 1952, increased to 11.2% by 1978. Therefore, we can guess that the decrease of the eastern share and the increase in the central and western areas was affected by the Construction of the Third Front (especially the western area), the economic reforms in rural areas, and protectionism by local governments. On the other hand, the eastern share has been increasing after the mid-1980s. Since, according to the National Bureau of Statistics of China [2002], population in 2000 is

## Table 9.1: Movements of Production Bases

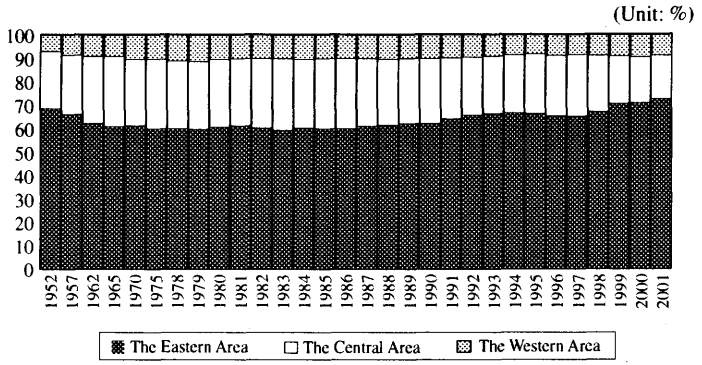
| Year | First (%) | | Second (%) | | Third (%) | | Fourth (%) | |
|---|---|---|---|---|---|---|---|---|
| 1952 | Shanghai | 19.3 | Liaoning | 13.1 | Jiangsu | 7.4 | Shandong | 5.8 |
| 1957 | Shanghai | 16.4 | Liaoning | 16.2 | Shandong | 6.0 | Jiangsu | 5.7 |
| 1962 | Shanghai | 16.4 | Liaoning | 11.2 | Jiangsu | 5.8 | Guangdong | 5.5 |
| 1965 | Shanghai | 16.0 | Liaoning | 11.9 | Heilongiang | 6.1 | Jiangsu | 6.1 |
| 1970 | Shanghai | 13.7 | Liaoning | 11.7 | Shandong | 6.2 | Heilongiang | 6.0 |
| 1975 | Shanghai | 12.7 | Liaoning | 10.2 | Jiangsu | 7.1 | Beijing | 6.0 |
| 1978 | Shanghai | 11.7 | Liaoning | 9.1 | Jiangsu | 7.7 | Shandong | 6.8 |
| 1979 | Shanghai | 11.5 | Liaoning | 8.8 | Jiangsu | 8.0 | Shandong | 6.5 |
| 1980 | Shanghai | 11.3 | Jiangsu | 8.9 | Liaoning | 8.8 | Shandong | 6.4 |
| 1981 | Shanghai | 11.2 | Jiangsu | 9.1 | Liaoning | 8.5 | Shandong | 6.5 |
| 1982 | Shanghai | 10.6 | Jiangsu | 9.0 | Liaoning | 8.2 | Shandong | 6.6 |
| 1983 | Shanghai | 10.0 | Jiangsu | 9.1 | Liaoning | 8.1 | Shandong | 6.7 |
| 1984 | Jiangsu | 9.7 | Shanghai | 9.4 | Liaoning | 7.9 | Shandong | 6.9 |
| 1985 | Jiangsu | 10.7 | Shanghai | 8.9 | Liaoning | 7.4 | Shandong | 7.0 |
| 1987 | Jiangsu | 11.6 | Shanghai | 7.9 | Shandong | 7.6 | Liaoning | 6.5 |
| 1988 | Jiangsu | 12.1 | Shandong | 8.2 | Guangdong | 7.4 | Shanghai | 7.3 |
| 1989 | Jiangsu | 11.8 | Shandong | 9.0 | Guangdong | 7.7 | Shanghai | 7.3 |
| 1990 | Jiangsu | 12.0 | Shandong | 9.5 | Guangdong | 8.2 | Shanghai | 7.1 |
| 1991 | Jiangsu | 11.4 | Shandong | 9.4 | Guangdong | 9.1 | Shanghai | 7.0 |
| 1992 | Jiangsu | 13.1 | Guangdong | 9.8 | Shandong | 8.7 | Zhejiang | 6.9 |
| 1993 | Jiangsu | 13.8 | Guangdong | 10.2 | Shandong | 9.1 | Zhejiang | 7.4 |
| 1994 | Jiangsu | 13.8 | Guangdong | 10.2 | Shandong | 9.9 | Zhejiang | 8.1 |
| 1995 | Jiangsu | 11.8 | Guangdong | 11.7 | Zhejiang | 9.9 | Shandong | 9.2 |
| 1996 | Jiangsu | 11.9 | Guangdong | 10.8 | Shandong | 9.4 | Zhejiang | 9.1 |
| 1997 | Jiangsu | 11.3 | Guangdong | 11.2 | Zhejiang | 9.4 | Shandong | 9.0 |
| 1998 | Guangdong | 11.9 | Jiangsu | 11.4 | Zhejiang | 9.8 | Shandong | 9.1 |
| 1999 | Guangdong | 14.5 | Jiangsu | 12.3 | Shandong | 9.6 | Shanghai | 7.5 |
| 2000 | Guangdong | 14.6 | Jiangsu | 12.2 | Shandong | 9.7 | Zhejiang | 7.7 |
| 2001 | Guangdong | 14.7 | Jiangsu | 12.3 | Shandong | 9.8 | Zhejiang | 8.3 |

Note: As for Figure 9.1.
Source: As for Figure 9.1.

| Fifth (%) | | Sum of Above Three (%) | Each Area Share (%) | | | Industrial Disparity Index |
|---|---|---|---|---|---|---|
| | | | East | Central | West | |
| Guangdong | 5.8 | 39.9 | 68.9 | 23.9 | 7.2 | 0.5181 |
| Tianjin | 5.6 | 38.6 | 66.8 | 24.6 | 8.7 | 0.4917 |
| Heilongiang | 5.4 | 33.4 | 62.5 | 28.1 | 9.4 | 0.4588 |
| ShJiangsu | 6.0 | 31.7 | 61.0 | 28.4 | 10.6 | 0.4490 |
| Shandong | 5.7 | 30.0 | 60.5 | 28.9 | 10.6 | 0.4333 |
| Beijing | 5.8 | 28.5 | 60.5 | 28.3 | 11.2 | 0.4217 |
| Beijing | 5.9 | 28.3 | 60.0 | 28.9 | 11.1 | 0.4174 |
| Beijing | 5.9 | 29.0 | 61.2 | 28.4 | 10.5 | 0.4235 |
| Beijing | 5.7 | 28.8 | 61.5 | 28.4 | 10.0 | 0.4250 |
| Beijing | 5.6 | 29.9 | 60.6 | 29.0 | 10.5 | 0.4145 |
| Beijing | 5.5 | 27.2 | 60.0 | 29.4 | 10.6 | 0.4112 |
| Guangdong | 5.6 | 27.0 | 60.6 | 28.7 | 10.7 | 0.4112 |
| Zhejiang | 5.7 | 26.9 | 60.7 | 28.6 | 10.7 | 0.4119 |
| Zhejiang | 6.1 | 26.7 | 60.6 | 28.8 | 10.5 | 0.4143 |
| Guangdong | 6.4 | 27.1 | 61.2 | 28.5 | 10.2 | 0.4201 |
| Zhejiang | 6.4 | 27.6 | 62.1 | 27.6 | 10.3 | 0.4429 |
| Zhejiang | 6.3 | 28.6 | 62.2 | 27.3 | 10.6 | 0.4433 |
| Zhejiang | 6.2 | 29.7 | 62.7 | 26.6 | 10.7 | 0.4479 |
| Liaoning | 6.5 | 29.9 | 64.4 | 25.2 | 10.4 | 0.4584 |
| Shanghai | 6.8 | 31.6 | 65.8 | 24.3 | 9.8 | 0.4745 |
| Shanghai | 6.5 | 33.1 | 66.6 | 23.9 | 9.4 | 0.4861 |
| Shanghai | 6.0 | 33.9 | 66.7 | 24.3 | 8.9 | 0.5004 |
| Shanghai | 6.5 | 33.5 | 66.8 | 24.6 | 8.5 | 0.5119 |
| Henan | 5.4 | 32.1 | 65.2 | 25.4 | 9.4 | 0.5074 |
| Hebei | 5.4 | 31.9 | 65.1 | 25.6 | 9.3 | 0.5085 |
| Hubei | 5.8 | 33.1 | 67.2 | 23.3 | 9.5 | 0.5219 |
| Zhejiang | 7.1 | 36.3 | 70.1 | 20.2 | 9.6 | 0.5216 |
| Shanghai | 7.2 | 36.5 | 70.9 | 19.7 | 9.4 | 0.5253 |
| Shanghai | 7.3 | 36.8 | 71.6 | 19.1 | 9.3 | 0.5311 |

eastern 41.6%, central 35.3%, and western 23.1% (year-end), the industrial concentration in the eastern area is stronger than population distribution.

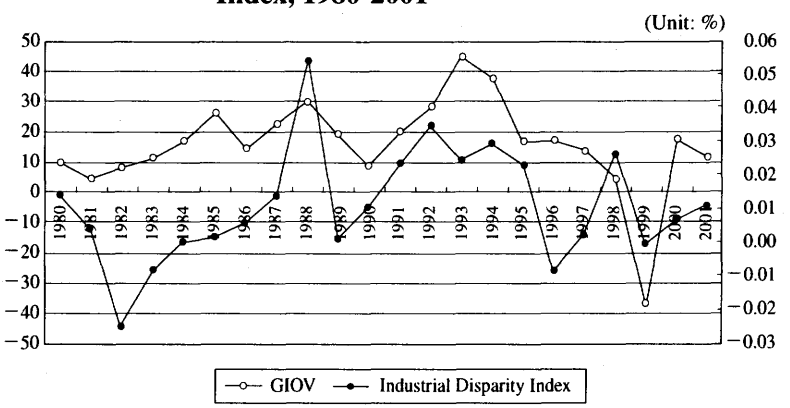
**Figure 9.2: Ratio of Each Area**




Note 1: As for Figure 9.1.
2: The years without figures are omitted.
Source: As for Figure 9.1.

Figure 9.3 shows that there is a relation between change rates of the industrial disparity index and change rates of GIOV. Although change rates of the industrial disparity index were minus before the mid-80s, both rates

**Figure 9.3: Change Rates of GIOV and Industrial Index, 1980-2001**




Note 1: As for Figure 9.1.
2: The years without figures are omitted.
3: The graduation of the left axis is for GIOV, the right is for Industrial Disparity Index.
Source: As for Figure 9.1.

start to move similarly after it. Since the economy at the end of the 1980s was shrinking, we can see from the changes that regional industrial disparity extends with economic growth in the 1990s.

### 2.4. Conclusion

China's regional industrial disparity had been decreasing till the 1980s because of political reasons and regional protectionism. But, the disparity has been increasing since the 1990s. Movements of production bases brought about the change of disparity in terms of share between the eastern and other areas, and movements between the northeast and the southeast, basically. And, agglomerations of the central area's some provinces near the coast or along the Yangtze River were also found.

## 3. INDUSTRIAL AGGLOMERATION IN THE EASTERN AREA

### 3.1. Definition of Industrial Agglomeration

Here, we will specify causes of an industrial agglomeration through linkages modeled by recent literature on spatial economics such as Fujita *et al.* [1999]. Industrial agglomeration as a phenomenon, here production concentrations in some areas, is developed as the relative results of the following parameters: an increase of demand of manufactures; a decline of transportation cost; and the importance of division of labor among firms.[11] This is defined by referring to Fujita *et al.* [1999], and Fujita and Hamaguchi [2001] mentioning relations between transactions of intermediate goods and spatial structures. In addition to the papers on spatial economics, a notion of division of labor among firms itself is based on Dixit and Stiglitz [1977] explaining the relation between variety of commodities and scale economies. Here, we will use the term, division of labor among firms, however, this notion is related with specialization and roundabout production in the sense of raising productivity of various manufacturing processes.

Krugman [1991] examined, under an industry sector with imperfect competition due to increasing returns to scale, whether consumption goods manufacturers locate uniformly or not. The result is related relative to an increase in demand by manufacturers, a decline of transportation cost, and consumers preferring a variety of consumption.[12]

Here we let the final goods of industries be intermediate ones of the

machinery industry. And, then relative relations of an increase of demand for the machinery industry, a decline of transportation cost, and the importance of variety generate linkages as well as the definition of agglomeration at the beginning of this section.[13]

To consider the mechanism of industrial agglomeration is important as the government played a big role to change industrial locations as introduced in 2.2. Therefore, these are cases where the government gathered firms into specific areas. But, it is necessary to confirm whether firms were gathered or not, as results of their decisions after governmental intervention, namely their economic rationality. Cases introduced in 2.2 are not all ones that were gathered by the government. Development zones are examples of this.[14] They offer hard and soft infrastructures, such as sites, utilities, introduction of accounts and lawyers, and so on, to reduce costs for firms. And, in addition to the development zones, the most important policy when we consider the development of the eastern area is the introduction of foreign capital, especially after 1992.[15] Although, we cannot ignore this good treatment strategy for the eastern area, however, we will focus on the agglomeration process after investment.

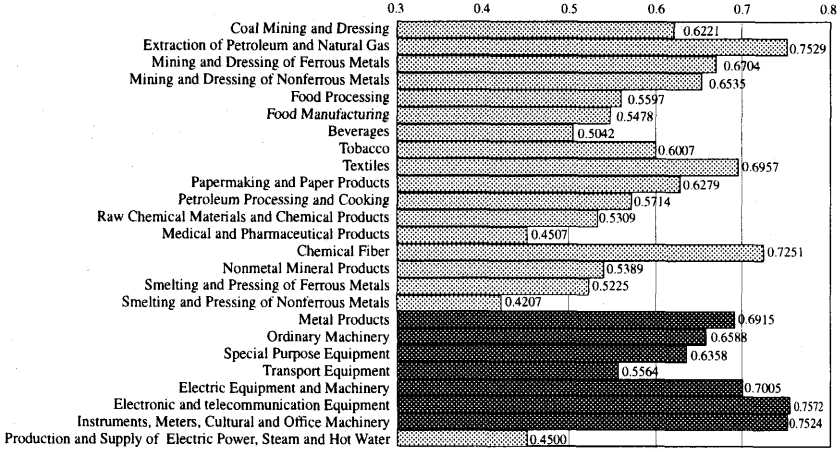
### 3.2. The Machinery Industry

To select an industry to proceed to discuss China's agglomeration, and since every industry demands machines to raise productivity, the machinery industry is chosen here. In addition, since the processing and assembly industry, namely, the machinery industry brings larger and deeper production levels than the basic material industry as Murakami [1999] and Kitakyushu City [2002] mentioned, and recognized generally, it seems quite probable that the machinery industry, if it is related geographically, leads potentially to industrial agglomeration.[16] In fact, as the processing and assembly industry needs a lot of parts to produce a machine essentially, the industry has a tendency of division of labor among firms. This is consistent with the abovementioned hypothesis of variety applied to the machinery industry. Especially, this development of deeper production levels corresponds to roundabout production and specialization as division of labor among firms.[17]

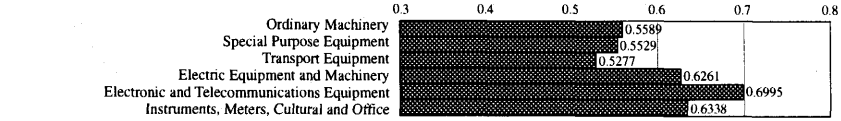
To compare the same industrial classification revised in 1994, we take up the industrial disparity indices by sector in 2000 and the machinery industry in 1994 in Figure 9.4a and 9.4b, respectively. In Figure 9.4a, since the arithmetic mean of the industrial disparity index of manufacturing is 0.5952, we can see regional high disparity of the machinery industry rela-

## Figure 9.4: Industrial Disparity Index, by sector, 2000 and 1994

**a: Industrial Disparity Index, by sector, 2000**




**b: Industrial Disparity Index, by sector of the machinery industry, 1994**




Note 1: As for Note 1 of Figure 9.1.
2: The GIOVs are calculated at current prices.

Sources: The figures for 4a are from Department of Industrial and Transport Statistics of National Bureau of Statistics (DITSNBS) [2001]. *China Industry Economy Statistical Yearbook 2001*, Beijing: China Statistical Press.
The figures for 4b are from DITSNBS [1996]. *China Industrial Economic Statistical Yearbook 1995*, Beijing: China Statistical Press.

tively, except for transport equipment.[18] The arithmetic mean of the industrial disparity index of the machinery industry is 0.6768. On the other hand, in Figure 9.4b, the arithmetic mean of the industrial disparity index for the machinery industry is 0.5998. We see that the machinery industry had been concentrated since 1994.

## 3.3. An Explanation of China's Industrial Agglomeration

To consider each above-mentioned parameter, we show a proportion of machinery industry output value in the mining and manufacturing industries, and division of labor of inter-firms by macro data and a personal interview, as each proxy except for transportation cost. The states of the coastal eastern development will be explained by some macro data and a personal interview from a firm.

### *3.3.1. Share of the Machinery Industry in the Mining and Manufacturing Industries*

Let us confirm the change of needs for a sector of the machinery industry. Certainly, there are demands from every sector as mentioned above, however, we will focus on demands for the machinery industry that come from the machinery industry itself because of transactions among firms classified within the machinery industry.[19]

Table 9.2 indicates that shares of machinery industry output value in the mining and manufacturing industries have been growing since 1993. We can see that there is a foundation to agglomerate within the machinery industry in some place(s).[20]

### *3.3.2. Some Data of Intermediate Goods Transactions*

To see the state of transactions of intermediate goods among firms in China, some data will be utilized. Since there is agglomeration in the eastern area as shown in section 2, certainly, we are focusing on the eastern area here. But, as our interest here is to explain the relation between agglomeration itself and intermediate goods transaction, the state of intermediate goods transaction in China will be introduced as follows. From the mid-1980s to the mid-1990s will be in 3.3.2, and from the present and the future will be in 3.3.3.

At first, Murakami [1999] will be introduced as follows. He studied trans-

## Table 9.2: Share of the Machinery Industry in GIOV, 1994-2000 (at current prices)

| | 1994 | (%) | 1995 | (%) | 1996 | (%) | 1997 | (%) |
|---|---|---|---|---|---|---|---|---|
| GIOV | 51,353.03 | | 54,946.86 | | 62,740.16 | | 68,352.68 | |
| Machinery Industry | 12,120.80 | 23.6 | 12,975.99 | 23.6 | 15,093.65 | 24.1 | 16,894.54 | 24.7 |
| Ordinary Machinery | 2,391.75 | 4.7 | 2,365.69 | 4.3 | 2,680.92 | 4.3 | 2,813.35 | 4.1 |
| Special Purpose Equipment | 1,791.90 | 3.5 | 1,756.54 | 3.2 | 1,988.14 | 3.2 | 2,071.02 | 3.0 |
| Transport Equipment | 3,185.80 | 6.2 | 3,303.28 | 6.0 | 3,785.01 | 6.0 | 4,123.10 | 6.0 |
| Electric Equipment and Machinery | 2,327.04 | 4.5 | 2,594.30 | 4.7 | 3,059.76 | 4.9 | 3,366.09 | 4.9 |
| Electronic and Telecommunications Equipment | 1,999.86 | 3.9 | 2,530.48 | 4.6 | 3,051.09 | 4.9 | 3,921.03 | 5.7 |
| Instruments, Meters, Cultural and Office Machinery | 424.45 | 0.8 | 425.70 | 0.8 | 528.73 | 0.8 | 599.95 | 0.9 |

| | 1998 | (%) | 1999 | (%) | 2000 | (%) |
|---|---|---|---|---|---|---|
| GIOV | 67,737.14 | | 72,707.04 | | 85,673.66 | |
| Machinery Industry | 17,955.97 | 26.5 | 19,892.16 | 27.4 | 23,856.58 | 27.8 |
| Ordinary Machinery | 2,579.80 | 3.8 | 2,693.90 | 3.7 | 3,046.95 | 3.6 |
| Special Purpose Equipment | 1,920.27 | 2.8 | 1,980.71 | 2.7 | 2,192.63 | 2.6 |
| Transport Equipment | 4,241.01 | 6.3 | 4,659.31 | 6.4 | 5,364.83 | 6.3 |
| Electric Equipment and Machinery | 3,628.58 | 5.4 | 4,021.55 | 5.5 | 4,834.68 | 5.6 |
| Electronic and Telecommunications Equipment | 4,893.56 | 7.2 | 5,830.96 | 8.0 | 7,549.58 | 8.8 |
| Instruments, Meters, Cultural and Office Machinery | 692.75 | 1.0 | 705.73 | 1.0 | 867.91 | 1.0 |

Note 1: As for Figure 9.4.

2: The figures for values are at current prices.

Sources: The figures for 1994 to 1999 are from Department of Industrial and Transport Statistics of National Bureau of Statistics (DITSNBS) [2000]. *China Industry, Tranport, and Energy Statistical Data and Materials on 50 years (1949-1999)*, Beijing: China.

The figures for 2000 are from DITSNBS [2000]. *China Industry Economy Statistical Yearbook 2001*, Beijing: China Statistical Press.

actions among firms to investigate the development of division of labor among firms. In his paper citing industrial census in 1985 and analysis by a team of the State Council, it was introduced that the average of external purchases of parts to gross industrial total value in China, 44.96%, was much lower than the average in developed countries, 70% to 80%, such as Japan and the US. In addition, this figure is just an average, representative types of industry, such as metalworking machinery and electric machinery, were lower than the average. Therefore, the low figures indicated underdevelopment of division of labor among firms at that time.

After the introduction of results from the census, Murakami showed development of transactions among firms from his enterprise survey in Wuhan, as seen in Table 9.3. The shares of Wuhan's machinery industry in the nationwide total grew from 1.04% in 1994 to 1.24% in 1997, and from 1.23% in 1998 to 1.28% in 2000.[21] Therefore, although Wuhan is a city in the central area, it also has agglomeration at the city level. In fact, in Table 9.1, Hubei where Wuhan belongs as the capital was ranked in fifth in 1998. As Dongfeng-Citroën Automobile Co., Ltd. is located there, the automobile industry is one of four major industries of Wuhan, with machinery industry. In addition, Wuhan is as much a stronghold of higher education and scientific research as Beijing, Shanghai, and Xi'an taken up in the next section.

Table 9.3 points out the following. The ratios of the machinery industry are higher than the ratios of the textile industry because the former is the processing and assembly industry. Moreover, there are increases of the ratio after 1985 in the machinery industry. And, newer founded firms of SOEs and urban collective-owned enterprises (in the Table, UCOE) had placed their orders with outside suppliers because the upper lines are higher than the lower ones.

In addition to the survey in Wuhan, Murakami added the case of Tianjin from 1985 to 1990. As seen in Table 9.4, ratios of Tianjin where more developed than Wuhan and were higher than Wuhan, that is to say, division of labor among firms in Tianjin is more developed. But, since the changes are not so big, limits of development are noticed.

Next, China's inter-regional Input-Output (hereafter, I-O) Table developed by Okamoto [2002] will be utilized here. This 'inter-regional' term includes the eastern, central, and western areas as adopted above. Table 9.5a and 9.5b are tables of the machinery industry without electric and electronic equipment, and electric and electronic equipment in 1987 and 1997 respectively. In this Table and Table 9.6 and 9.7, each area of the row is the origin of each sector, and each area of the column is the destination. In

## Table 9.3: External Purchase of Parts to Total External Purchase Ratio in Wuhan

(Unit: %)

| | Machinery Industry | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1980 | | 1985 | | 1990 | | 1994 | |
| SOEs | 9.4 | (21) | 6.1 | (21) | 6.2 | (21) | 7.0 | (21) |
| | 9.4 | (21) | 6.2 | (24) | 7.3 | (26) | 9.3 | (27) |
| UCOEs | 11.2 | (14) | 12.3 | (14) | 14.7 | (14) | 18.0 | (14) |
| | 11.4 | (16) | 10.5 | (18) | 15.3 | (24) | 19.5 | (29) |
| TVEs | n.a. | | n.a. | | n.a. | | 5.0 | |
| PEs and JVs | n.a. | | n.a. | | n.a. | | 16.1 | |

(Unit: %)

| | Textile Industry | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1980 | | 1985 | | 1990 | | 1994 | |
| SOEs | 2.9 | (15) | 3.0 | (15) | 3.8 | (15) | 3.7 | (15) |
| | 2.8 | (16) | 2.8 | (16) | 3.6 | (17) | 3.0 | (19) |
| UCOEs | 2.3 | (11) | 1.9 | (11) | 2.9 | (11) | 1.6 | (11) |
| | 2.7 | (13) | 2.0 | (15) | 2.3 | (19) | 1.0 | (17) |
| TVEs | n.a. | | n.a. | | n.a. | | 2.8 | |
| PEs and JVs | n.a. | | n.a. | | n.a. | | 4.7 | |

Note 1: The "SOEs" indicate state-owned enterprises. The "UCOEs" indicate urban collective-owned enterprises. "TVEs" indicate township and village enterprises. The "PEs" indicate private enterprises. The "JVs" indicate joint venture enterprises (foreign-affiliated enterprises).

2: External purchase of parts to total external purchase ratio = External purchase of parts / (External purchase of parts + External purchase of raw material) × 100.

3: The figures in parentheses are the number of sample firmes.

4: The upper sections of "SOEs" and "UCOMs" indicate samples of all four years, and lower sections are all valid samples of each year.

5: The "n.a." indicates that there are no data on them.

Source: Murakami [1999].

## Table 9.4: External Purchase of Parts to Total External Purchase Ratio in Tianjin

(Unit: %)

| | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|
| SOEs | 21.1 | 21.3 | 20.4 | 21.1 | 20.7 | 21.2 |
| UCOEs | 21.3 | 21.0 | 20.1 | 20.1 | 20.5 | 20.8 |
| PEs and JVs | 30.0 | 30.2 | 29.6 | 28.0 | 28.4 | 26.8 |

Note 1: As for Note 1 and 2 of Table 9.3.

2: The number of samples of SOEs, UCOEs, and PEs and JVs are 89, 43, and 5, respectively.

Source: As for Table 9.3.

## Table 9.5: Inter-Regional Input-Output Table, 1987 and 1997

**a: 1987**

| | E-General | E-Electro | C-General | C-Electro | W-General | W-Electro | Row Total |
|---|---|---|---|---|---|---|---|
| E-General | 2,532,019 | 297,622 | 445,577 | 27,656 | 116,748 | 9,921 | 3,429,543 |
| E-Electro | 625,392 | 1,651,930 | 86,615 | 120,810 | 29,222 | 55,802 | 2,569,771 |
| C-General | 518,366 | 60,930 | 613,833 | 38,100 | 32,492 | 2,761 | 1,266,482 |
| C-Electro | 67,607 | 178,580 | 63,007 | 87,882 | 4,294 | 8,201 | 409,571 |
| W-General | 110,166 | 12,949 | 58,680 | 3,642 | 377,832 | 32,106 | 595,375 |
| W-Electro | 19,671 | 51,960 | 8,246 | 11,502 | 68,369 | 130,554 | 290,302 |
| Column Total | 3,873,221 | 2,253,971 | 1,275,958 | 289,592 | 628,957 | 239,345 | 8,561,044 |

**b: 1997**

| | E-General | E-Electro | C-General | C-Electro | W-General | W-Electro | Row Total |
|---|---|---|---|---|---|---|---|
| E-General | 27,053,211 | 2,870,148 | 3,317,625 | 106,134 | 689,067 | 114,605 | 34,150,790 |
| E-Electro | 5,694,137 | 23,211,517 | 285,305 | 350,693 | 116,659 | 745,507 | 30,403,818 |
| C-General | 4,918,440 | 521,811 | 2,124,994 | 67,981 | 84,364 | 14,031 | 7,731,621 |
| C-Electro | 312,161 | 1,272,488 | 55,104 | 67,733 | 4,307 | 27,523 | 1,739,316 |
| W-General | 757,960 | 80,414 | 202,485 | 6,478 | 673,789 | 112,064 | 1,833,190 |
| W-Electro | 250,099 | 1,019,502 | 27,298 | 33,554 | 178,829 | 1,142,804 | 2,652,086 |
| Column Total | 38,986,008 | 28,975,880 | 6,012,811 | 632,573 | 1,747,015 | 2,156,534 | 78,510,821 |

Note 1: The "E," "C," and "W" indicate the easetern, the central, and the western area respectively.
2: The "General" indicates machinery industry without electric and electronic equipment.
The "Electro" indicates electric and electronic equipment.

Source: Okamoto [2002].

## Table 9.6: Ratio of Increase between 1987 and 1997

| | E-General | E-Electro | C-General | C-Electro | W-General | W-Electro | Ratio to Total |
|---|---|---|---|---|---|---|---|
| E-General | 9.68 | 8.64 | 6.45 | 2.84 | 4.90 | 10.55 | 8.96 |
| E-Electro | 8.10 | 13.05 | 2.29 | 1.90 | 2.99 | 12.36 | 10.83 |
| C-General | 8.49 | 7.56 | 2.46 | 0.78 | 1.60 | 4.08 | 5.10 |
| C-Electro | 3.62 | 6.13 | –0.13 | –0.23 | 0.00 | 2.36 | 3.25 |
| W-General | 5.88 | 5.21 | 2.45 | 0.78 | 0.78 | 2.49 | 2.08 |
| W-Electro | 11.71 | 18.62 | 2.31 | 1.92 | 1.62 | 7.75 | 8.14 |
| Ratio to Total | 9.07 | 11.86 | 3.71 | 1.18 | 1.78 | 8.01 | 8.17 |

Note: As for Table 9.5.

Source: As for Table 9.5.

## Table 9.7: Dependence Ratio of Supply and Demand, 1987 and 1997

**a: Supply, 1987**

| | E-General | E-Electro | C-General | C-Electro | W-General | W-Electro | Ratio to Total |
|---|---|---|---|---|---|---|---|
| E-General | 0.74 | 0.09 | 0.13 | 0.01 | 0.03 | 0.00 | 1.00 |
| E-Electro | 0.24 | 0.64 | 0.03 | 0.05 | 0.01 | 0.02 | 1.00 |
| C-General | 0.41 | 0.05 | 0.48 | 0.03 | 0.03 | 0.00 | 1.00 |
| C-Electro | 0.17 | 0.44 | 0.15 | 0.21 | 0.01 | 0.02 | 1.00 |
| W-General | 0.19 | 0.02 | 0.10 | 0.01 | 0.63 | 0.05 | 1.00 |
| W-Electro | 0.07 | 0.18 | 0.03 | 0.04 | 0.24 | 0.45 | 1.00 |
| Ratio to Total | 0.45 | 0.26 | 0.15 | 0.03 | 0.07 | 0.03 | 1.00 |

**b: Supply, 1997**

| | E-General | E-Electro | C-General | C-Electro | W-General | W-Electro | Ratio to Total |
|---|---|---|---|---|---|---|---|
| E-General | 0.79 | 0.08 | 0.10 | 0.00 | 0.02 | 0.00 | 1.00 |
| E-Electro | 0.19 | 0.76 | 0.01 | 0.01 | 0.00 | 0.02 | 1.00 |
| C-General | 0.64 | 0.07 | 0.27 | 0.01 | 0.01 | 0.00 | 1.00 |
| C-Electro | 0.18 | 0.73 | 0.03 | 0.04 | 0.00 | 0.02 | 1.00 |
| W-General | 0.41 | 0.04 | 0.11 | 0.00 | 0.37 | 0.06 | 1.00 |
| W-Electro | 0.09 | 0.38 | 0.01 | 0.01 | 0.07 | 0.43 | 1.00 |
| Ratio to Total | 0.50 | 0.37 | 0.08 | 0.01 | 0.02 | 0.03 | 1.00 |

**c: Demand, 1987**

| | E-General | E-Electro | C-General | C-Electro | W-General | W-Electro | Ratio to Total |
|---|---|---|---|---|---|---|---|
| E-General | 0.65 | 0.13 | 0.35 | 0.10 | 0.19 | 0.04 | 0.40 |
| E-Electro | 0.16 | 0.73 | 0.07 | 0.42 | 0.05 | 0.23 | 0.30 |
| C-General | 0.13 | 0.03 | 0.48 | 0.13 | 0.05 | 0.01 | 0.15 |
| C-Electro | 0.02 | 0.08 | 0.05 | 0.30 | 0.01 | 0.03 | 0.05 |
| W-General | 0.03 | 0.01 | 0.05 | 0.01 | 0.60 | 0.13 | 0.07 |
| W-Electro | 0.01 | 0.02 | 0.01 | 0.04 | 0.11 | 0.55 | 0.03 |
| Ratio to Total | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

**d: Demand, 1997**

| | E-General | E-Electro | C-General | C-Electro | W-General | W-Electro | Ratio to Total |
|---|---|---|---|---|---|---|---|
| E-General | 0.69 | 0.10 | 0.55 | 0.17 | 0.39 | 0.05 | 0.43 |
| E-Electro | 0.15 | 0.80 | 0.05 | 0.55 | 0.07 | 0.35 | 0.39 |
| C-General | 0.13 | 0.02 | 0.35 | 0.11 | 0.05 | 0.01 | 0.10 |
| C-Electro | 0.01 | 0.04 | 0.01 | 0.11 | 0.00 | 0.01 | 0.02 |
| W-General | 0.02 | 0.00 | 0.03 | 0.01 | 0.39 | 0.05 | 0.02 |
| W-Electro | 0.01 | 0.04 | 0.00 | 0.05 | 0.10 | 0.53 | 0.03 |
| Ratio to Total | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Note: As for Table 9.5.

Source: As for Table 9.5.

Table 9.5, the lowest row is the total of each column, and the column on the right end is the total of the row. They are ratios to totals of columns and rows respectively in Table 9.6 and Table 9.7. Although various facts are found from the Tables, let us focus on intra-regional transactions of intermediate goods in each area.

In 1987, since every intra-regional transaction of the same sector is the largest value except for intra-regional transaction in the central area, we can see that production in each area supplied parts for each local demand.

On the other hand, in 1997, intermediate goods from the eastern area, certainly they were from local supplies in the eastern area, were larger than local supply except for the electric and electronic equipment in the eastern area.

Table 9.6 is a ratio of increase between two points in time. As the table indicates, only ratios of the eastern area, 9.68 and 13.05, exceeded ratios of total supply, 9.07 and 11.86, and demand, 8.96 and 10.83, of each sector. Namely, intra-area transaction among firms in the eastern area exceeded output to outside and input from outside.

Table 9.7a and 9.7b are ratios of each area demand to each area supply, that is to say, the value of supply dependence by area. These Tables tell us that dependence of supply from the eastern area for the central and the western areas was strengthened from 1987 to 1997. Especially, dependence of the central area was strengthened. Influences from the eastern area to the western area seem to be weaker than to the central area from the viewpoint of transportation cost in a wide sense.

In the same way, Table 9.7c and 9.7d are ratios of each area supply to each area demand, that is to say, the value of demand dependence by area. These tables also tell us that dependence on supply from the eastern area for especially the central and western areas was strengthened.

### *3.3.3. A Case of Intermediate Goods Transactions*

In this section, a case of transaction of parts among firms in the eastern area will be reported. This case is based on a personal interview (12 September 2002, in Guangzhou) at Japanese transport equipment Company A (established in 1998) producing automobiles in Guangzhou, Guangdong. Company A produced 100,000 cars in March 2002 since beginning operations accumulately.

They assemble about 1,800 parts to produce an automobile at their assemble factory. About 60% of the items are purchased in China and the rest

are imported from foreign counties. About 70% of the 40% are imported from Japan and the remaining 30% imported from the US, Malaysia, and Thailand. Half of the intra-China purchasing is purchased in Guangdong, about 30% in Shanghai, and about 20% from other areas. Therefore, quantitatively, a lot of parts are made at the eastern area. In the eastern area, according to the case of Company A, we can find that there are two large industrial agglomerations of automobile companies. One is in the Yangtze River Delta area. It has a longer history than the other, Guangdong, because European and American automobile companies were established before Company A in the Yangtze River Delta area. But, the agglomeration in Guangdong has also been developed when they came there.

Half of the items in amount are purchased in Guangdong where Company A is located. Especially in the province, a lot of intermediate goods companies are located in the Pearl River Delta area locating near Company A. In particular, the suppliers are located in Guangzhou, Dongguan, Foshan, and Zhongshan. In addition, companies making large volume parts located near Company A after taking transportation costs into consideration. Consequently, a lot of direct parts companies for Company A are gathered in a specific area.[22]

Next, let us examine the situation from a capital point of view. Company A has dealings with about 100 companies, about 75% of them are Japanese companies, about 20% Chinese, and the others European and American. In addition, by value, 90% or above are purchased from Japanese companies with about 5% to 6% purchased from Chinese companies.

Here let us give some supplementary explanation. According to China's Customs statistics import value of machinery has been increasing the same as export value, see Table 9.8.[23] Therefore, we see from foreign trade statistics that China needs intermediate goods from foreign countries to export more machinery because of the underdevelopment of supporting industry. In fact as seen in Table 9.9, value of parts and accessories for four-wheeled vehicles has been increasing in the same way as export value. On the other hand, export values of parts and accessories for motorcycles and other car-

**Table 9.8: Foreign Trade Value of Machinery, 1995-2001**

(Unit: Million US dollar)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|
| Export | 36,691.95 | 40,612.90 | 50,129.12 | 56,721.07 | 65,713.23 | 90,706.42 | 102,944.89 |
| Import | 57,023.09 | 59,120.60 | 57,010.24 | 61,636.60 | 75,018.08 | 99,766.05 | 117,040.53 |

Source: China Customs (World Trade Atras provided by Global Trade Services, Inc. is utilized).

**Table 9.9: Foreign Trade Value of Four-Wheeled Vehicles and Motorcycles, 1995-2001**

(Unit: Million US dollar)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|
| Four-Wheeled Vehicles | | | | | | | |
| Export | 223.97 | 206.39 | 247.77 | 201.47 | 160.26 | 252.69 | 262.26 |
| Import | 1,536.25 | 841.80 | 726.14 | 855.84 | 850.98 | 1,217.01 | 1,765.89 |
| Parts and Accessories | | | | | | | |
| Export | 373.26 | 379.64 | 444.66 | 527.07 | 778.95 | 1,121.31 | 1,350.60 |
| Import | 748.11 | 1,043.93 | 901.91 | 931.321, | 244.19 | 2,103.63 | 2,514.80 |
| Motorcycles | | | | | | | |
| Export | 46.81 | 42.98 | 61.84 | 64.83 | 127.34 | 747.07 | 747.42 |
| Import | 23.82 | 1.51 | 2.37 | 0.32 | 2.32 | 3.00 | 1.27 |
| Parts and Accessories | | | | | | | |
| Export | 290.28 | 367.76 | 480.99 | 488.47 | 484.91 | 657.55 | 752.86 |
| Import | 226.22 | 233.22 | 180.20 | 170.26 | 213.24 | 237.66 | 185.18 |

Note: The "Four-Wheled Vehicles" indicates 8701-8705 in HS code. The "Parts and Accessories" of the "Four-Wheled Vehicles" indicates 8708 (for 8701-8705) in HS code. The "Motorcycles" is 8711 in HS code. The "Parts and Accessories" of the "Motorcycles" indicates 8714 (for 8711-8713) is HS code.

Source: As for Table 9.6.

riages, which have a well-developed industry, exceed import values.

Although this is the present situation they intend to raise the value and the ratio of local content in order to reduce costs in the future. Therefore, what the low share held by Chinese companies at present makes clear is that there are few local players conducting transactions even in the eastern area for Company A. However, at the same time, there is the possibility for development of agglomeration, including by Chinese firms, as far as we draw a conclusion from the case of Company A.

### 3.4. Conclusion

To consider the mechanism for the change in disparity we defined an industrial agglomeration as production concentrations in some areas, with an increase in demand of manufacturers, a decline of transportation cost, and the importance of division of labor among firms (specialization). We showcased the machinery industry on account of its importance regarding productivity for all other industries and its character as the processing and assembly industry. At the same time, we saw that the disparity of machinery industry production among provinces increased.

To investigate the inevitability of agglomeration, at first, it was shown that shares of the machinery industry in the mining and manufacturing industries grew in the same way as the industrial disparity index of production. Next, an increase of intermediate goods transaction among firms in the city of high GIOV share of the province was shown. Thirdly, an increase of transactions in the eastern area was shown from the I-O Table. In addition, the actual state of transaction among firms was introduced using the case of a Japanese motorcar company. In such a manner, linkages as a factor to bring industrial agglomeration, namely, linkage-based spatial concentrations were shown. And, we explained the inevitability of agglomeration in the eastern area and near provinces as a core area, that is to say, the machinery industry in the area is in cumulative process.

## 4. THE WESTERN DEVELOPMENT

### 4.1. The 10th FYP and the Western Development

The 10th FYP ratified at the forth plenum of the ninth National People's Congress on 15 March 2001 covers 2001 to 2005. In an attempt to correct the regional disparity between the coastal and the inland area the plan has put weight on western development.[24] It is said that the push for western development originated with President Jiang Zeming's speech at Xi'an in June 1999. In the 10th FYP, the government put weight on western infrastructure, scientific technique and education, ecological environment, ethnic minorities, natural resources, agriculture, etc. For infrastructure especially some big projects such as the transfer of natural gas and electric power from the west to the east, and railways from Qinghai to Tibet, are presented concretely.

Although western development is attracting attention at present as mentioned in sections 2.2.1 and 2.2.2, the basic strategy for balanced regional development was expressed before the economic reform.

### 4.2. The Big-Push in a Core-Periphery Structure

#### *4.2.1. The Relation of the Big-Push and a Core-Periphery Structure*

This western development represents a case of the big-push theory as mentioned by Kato [2000]. Here, however, we see that the big-push theory proposed by Rosenstein-Rodan [1943] is to produce the intra-industry link-

ages (both forward and backward) artificially.[25] Therefore, the greater the investment in the western area the greater the possibility to move to higher equilibrium will be raised.

But, the relation between the coastal and inland area is the core-periphery structure in the context of agglomeration.[26] Namely, the problem facing the western area is in some aspects a structural one. The big-push theory deals with point economy, that is to say, non-space economy. Therefore, if we do not consider neo-classical economic growth completely here, it is more difficult to escape from the state of underdevelopment of the periphery. In addition, since Deng Xiaoping proposed allowing some people and areas to get rich first, the possibility of achieving this end will be more difficult because the lock-in effect works. Moreover, even if the present periphery becomes a center of production, then the existing core will become the new periphery. Therefore, the structural problem will remain.

Given these circumstances, not only for the western area but also for the rest of China, to consider what industries should be invested in to produce linkages is important to avoid wasteful investments. Nonetheless, the development strategy of the 10th FYP is to promote characteristics for pillar industries in the western area, such as agriculture, food processing, tourism, Chinese medicine, and so on. Although we withhold judgment on the 10th FYP including western development, to focus on characteristics seems to be an appropriate development strategy in our context.

Let us here take up the strategy for characteristics.[27] As mentioned in section 2.2.2, one of the policies to correct the imbalanced industrial location was the relocation of factories located in the coastal area before the economic reform, on the contrary, western development especially focuses to develop characteristics for pillar industries in each province of the western area.

### *4.2.2. A Case of Xi'an, Shaanxi*

In Xi'an, Shaanxi, for example, characteristics, such as aviation, and software are taken up in the 10th FYP for Shaanxi.

Let us first take a look at the situation of Xi'an.[28] In the first FYP (1953-57), 17 projects of the 156 national priority projects from the USSR were located here. As a consequence, although economic fundamentals were meager before modern China, the foundation for economic development had been laid. In the second FYP (1958-62) and the Construction of the Third Front, firms and institutions related with national defense moved here,

at present, this is a big foothold of machinery, spinning and weaving, and war industries in the northwestern area. Indeed it is the biggest base for the war industries in China. There are a lot of large-scale companies, such as China Xi'an Electric Manufacturing Cooperation and Xi'an Aero-Engine (Group) Ltd. In addition, this is a stronghold for higher education and scientific research in China. Although progress was stopped during the Cultural Revolution, the foundations were already developed. There are 42 institutions of higher education, such as Xi'an Jiaotong University and Northwestern Polytechnical University, and more than 30 science institutions of national class. As a result, Xi'an follows only Beijing and Shanghai in boasting talented people in the field of scientific technology.

Therefore, given the above backdrop, the 10th FYP for Shaanxi, presented by Shaanxi Provincial Development Planning Commission, focused on the electronic and telecommunications industry, aviation, and so on to further raise Xi'an's status as a high technology development zone following its designation as an open city in 1992. Development zones reflect in part the importance of these priority industries. The provincial plan aims to further boost Xi'an Software Park and Xinjianguang Electronic Industrial District in Xi'an National High-Tech Industrial Development Zone.

It follows from what has been said thus far that the given characteristics reflect accumulation until now, therefore, we can say that to develop the characteristic economy means to make a kind of cluster as the characteristic is a core in the process of industrialization and specialization of existing industries. Certainly, this 10th FYP does not aim to relocate firms and factories in the eastern area to the western area, the plan aims to raise existing industries. On the other hand, initial stages of the first FYP and the Construction of the Third Front in Xi'an and the other cities, especially Panzhihua, needed enormous investments to construct factories with housing, schools, hospitals, etc, as units (*danwei*). According to Kojima [1997], although this is not only the case for Xi'an, generally, construction costs for new factories in non-industrial cities are two to three times higher than in existing industrial cities because of the existence of required infrastructure, such as water for industrial use, roads, and communication networks.

Therefore, industries in such areas benefit from past investment, in other words, utilize each area's history. Although we do not infer whether these investments were intended to correct the gap between the coastal and the inland area or not, according to Marukawa [2002], Xi'an are making use of the subordinate result at present.

### 4.3. Conclusion

Finally, we saw the western development as a policy of a periphery area. After introducing the western development, difficulties of attaining the big-push in the context of structural results, and the core-periphery structure, were shown. However, the possibility to utilize characteristics of the western area was explained to develop there under the structural problem.

## 5. CONCLUDING REMARKS

In this chapter, we examined regional industrial disparity from the viewpoint of industrial agglomeration. Let us here summarize the main points again. The concentration in the eastern area as the center was found in the 1990s after dispersions of two periods. As one of the factors to explain the disparity, the idea of industrial agglomeration was utilized. From the share of the machinery industry in the mining and manufacturing industries and intermediate goods transaction, the inevitability of the disparity based on the working of linkages was indicated. In the core-periphery structure between the agglomerated area and the other areas, a policy implication and a counter-plan were shown. To develop the inland area, the importance of promoting characteristics for pillar industries was introduced.

These results lead us to the conclusion that the agglomeration effect in the eastern area is one of the factors to bring China's regional industrial disparity, and that western development has to let characteristics in the western area develop pillar industries.

But, some problems remain. One factor of three, transportation cost, was not investigated. This is a big problem, because this factor is a key in spatial economics. Next, normalization of the industrial value of each province was not considered. Certainly there are bigger gaps of GIOV than ones of population among the eastern, central and western areas as stated in 2.3, however, to normalize each set of provincial statistics by, for example, population or industrial structure, we need to investigate precisely. Thirdly, this chapter tried to explain Chinese agglomeration by using macro data mainly, however, the empirical conclusions remained. Fourthly, the lower levels of administrative division, such as the city level or the county level, also should be analyzed. Here, the provincial level and the area level (the eastern, the central, and the western areas) were basically dealt with. Finally, although this is extending our subject, we considered only linkages to explain centripetal forces, as Fujita *et al.* [1999] mentioned.

## Notes

[1] Although a view of international division of labor is essential to think of industrial agglomeration in China, here we concentrated on China's domestic distribution in accordance with macroeconomic data and some facts. We consider economic growth to present in terms of industrial agglomeration in the passage of the economic reform, than consider recent Chinese economy.

[2] This is almost the same as the definition by Marukawa [2001], but he supposes increasing return to scale at area level, not firm level. Since it is subject to availability of macro data, to make definite geographical scope is difficult.

[3] Confer Marukawa [2001] as the investigation.

[4] There are 22 provinces, four municipalities, and five autonomous regions at present. Hainan was made a separate province from Guangdong in 1988. Chongqing was designated a municipality from Sichuan in 1997. Here we exclude Hong Kong Special Administrative Region, Macao Special Administrative Region, and Taiwan.

[5] Although the number of firms is important to see agglomeration, we will take up gross industrial output value here.

[6] As mentioned in Note 1, the criterion of firms was changed after 1998. By the influence, shares of provinces that have a lot of large-scale enterprises comparatively will be overestimated.

[7] To explain brief the history, Kojima [1997] and Kato [2000] were referred to mainly.

[8] In addition, they are reallocated to the least developed areas as finance assistance.

[9] See for example Marukawa [1993, 2002]. We do not assess the policy, however, let it be regarded here as priority investments to the inland area due to national defense.

[10] These three economic zones were adopted in the 7th FYP (1986-1990). The eastern area includes 12 province-class divisions: Liaoning, Beijing, Tianjin, Hebei, Shandong, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong, Hainan, and Guangxi. The central area includes nine province-class divisions: Jilin, Heilongjiang, Inner Mongolia, Shanxi, Henan, Anhui, Hubei, Hunan, and Jiangxi. The western area includes 10 province-class divisions: Xinjiang, Tibet, Qinghai, Gansu, Ningxia, Shaanxi, Sichuan, Chongqing (contained in Sichuan at present), Yunnan, and Guizhou. According to National Bureau of Statistics of China [2002], GDP in 2001 is eastern 59.6%, central 26.9%, and western 13.6% (current prices).

[11] Sonobe and Otsuka [2002] analyzed Taiwan's industrial location from the viewpoint of the Becker and Murphy model of division of labor.

[12] In Krugam [1991], originally, demand of manufactures stands is a parameter $\mu$, transportation cost a parameter $\tau$, and consumers' preference to variety of consumption is a parameter $\sigma$.

[13] Transportation costs are not easy to conclude high or low here. According to a personal interview (September 10, 2002, in Tianjin) at a Japanese food processing Company B (established in 1997) producing bean jam from azuki beans in Tianjin, they said that transportation cost had decreased. At first, they located there to purchase high-quality beans till 1995, however, supply decreased because of a bad harvest, they then purchased from the northeastern area, from Heilongjiang at present. But, there is no motive to move near raw materials because of decreasing of transportation cost (Raw materials share of total cost is over 60%). In addition, on a charge of weight transported, as Okamoto [2002] mentioned in the section on intermediate goods, there is a data set concluded that weight of inter-region (east, central, and west) transportation increased from 1987 to 1997. In addition, there are data on development of transportation infrastructure and increases of weight. As mentioned above, there are some facts supporting development of transportation in China. But, it is difficult to conclude that transportation cost increased or decreased without an investigation of settlement of the bottleneck mentioned by Uchida [1988]. Therefore, we are not concerned with transportation in China.

[14] There are some reasons to set up development zones for every level of government. For example (a personal interview, September 2-6, 2002, in Ningbo and Cixi of county level), Cixi in Ningbo city, Zhejiang, set up some zones to realize scale economy. Especially, Ningbo has developed cluster economies to realize it. There were a lot of small factories there. As for other reasons, there are environmental conservation, investment selection for specific industries, and so on.

[15] On relations between foreign capital and development in the eastern area, see Ishihara [1998].

[16] As mentioned by Kitakyushu City [2002], from the viewpoint of a kind of industrial agglomeration, examined the problem of industrial structure weighted on the basic material industry in Kitakyushu City, Fukuoka Prefecture, Japan, compared with Higashi-Osaka City, Osaka Prefecture, weighted on the processing and assembly industry, the problem is recognized in the Kita-Kyushu industrial area generally.

[17] It is necessary to examine economic activities based on a number of firms to compare these characteristics of the machinery industry with the basic material industry precisely.

[18] The arithmetic mean of the industrial disparity index including the mining and quarrying industry is 0.6079 in 2000. Since locations for mining and high production provinces correspond, the mining and quarrying industry is a typical type located by resources. Especially, the high index of the extraction of petroleum and natural gas industry suggests that large-scale oil fields of Daqin, Shengli, and Liaohe have high shares.

[19] This treatment may not be natural, because, if we applied Krugman [1991] for the definition of industrial agglomeration, all manufacturing has importance of

variety. In addition, because all manufacturing is so, there is a trend that the machinery industry would agglomerate more in the same area agglomerated by other manufacturing. But, we take up the machinery industry to distinguish it from the others.

[20] According to Fujita *et al.* [1999], if the condition is that there are a lot of (more than two) places set up, there is the possibility to agglomerate in some places.

[21] Since data from 1980 to 1994 as the same time series of Table 9.3 are not available, data after 1994 are introduced here as a result of growing ratios of external purchase. The period from 1994 to 2000 was divided into two periods, because the criterion of firms was changed after 1998 as noted in Figure 9.1 etc. The percentages are calculated from Table 9.2 and "Wuhan Statistical Yearbook" compiled by Wuhan Statistical Bureau.

[22] There is a special case that shows the situation of gathering around a core assembler like the Beijing Economic-Technological Development Area according to a personal interview (September 9, 2002 in Beijing). The development area has some Joint Ventures' own zones that gathered their intermediate goods companies there.

[23] Export (import) share of machinery in total export (import) are 38.6 (48.1) in 2001 (The machinery industry includes 84 to 93 in HS code here). And, ordinary machinery (84) and electrical machinery (85) are ranked in first and second respectively. Therefore, the share of machinery in China's foreign trade is high.

[24] Although the western area includes 10 province-class divisions as mentioned above generally, the scope in the western development is 12 province-class divisions adding Guangxi in the eastern area and Inner Mongolia in the central area to the 10 divisions.

[25] Murphy, Shleifer, and Vishny [1989] formulized the general idea.

[26] Fujita and Thisse [2002] examined development of a periphery area under some specific conditions.

[27] Although big projects of infrastructures are essential in the 10th FYP, we do not deal with it. But one thing that must be mentioned here is the following. Infrastructure is important to develop industries in point economy, however, there is the possibility that the state of the core-periphery structure would be more developed because of a decrease in transportation cost between the core and periphery areas.

[28] Editorial Committee for Xi'an Annals [1996] and Uno [1999] are cited to introduce an outlook of Xi'an in this paragraph.

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